THE UNIVERSITY OF TEXAS AT AUSTIN Date: 09/05/2014

**RECOMMENDATION FOR CHANGE IN ACADEMIC RANK/STATUS**

Name: Todd Humphreys EID: th9536 Present Rank: Assistant Professor

Years of Academic Service ***(Include AY 2014-15 in each count)***:

At UT Austin since: 09/01/2009 (month/day/year) In Present Rank: 6.00 (# of years) In Probationary Status (**TT only**): 6 (# of full years)

Primary Department: Aerospace Engineering and Engineering Mechanics College/School: Cockrell School of Engineering

Joint Department: - College/School: -

Other Department(s): Applied Research Laboratories

Recommendation actions[1]:

By Budget Council/Executive Committee: Promote

Vote[2] for promotion 21; Against 0; Abstain 0; Absent 1; Ineligible to vote 0

By Department Chair: Promote

By College/School Advisory Committee: Promote

Vote for promotion 6; Against 1; Abstain 0; Absent 0

By Dean: Promote

Administrative Action: Promote to Associate Professor

Date Action Effective: September 1, 2015
(To be submitted to the Board of Regents as part of the annual budget.)

By: For the President Date: December 17, 2014

[1]See "Chart of Recommended Actions" for eligible recommended actions applicable to specific conditions and administrative levels.
[2]Record all votes for and against promotion, abstentions by eligible voting members, and the number of absent eligible voting members. The number of budget council/executive committee members ineligible to vote due to rank should also be recorded. Enter zero where it would otherwise be blank.

EVPP/10.14

EXHIBIT
P's 166

THE UNIVERSITY OF TEXAS AT AUSTIN
COCKRELL SCHOOL OF ENGINEERING

*Office of the Dean • 301 E. Dean Keeton Street, C 2100 • Austin, Texas 78712-2100*

**Dean's Assessment**
Todd E. Humphreys
Department of Aerospace Engineering and Engineering Mechanics

Todd Humphreys received his BS and MS degrees in Electrical and Computer Engineering from Utah State University in 2000 and 2003, respectively, and a PhD degree in Aerospace Engineering from Cornell University in 2008. Following graduation, Dr. Humphreys served as a researcher and co-founder of Coherent Navigation for one year before beginning his tenure-track appointment as assistant professor in the Department of Aerospace Engineering and Engineering Mechanics at the University of Texas in Austin in August 2009. If successfully promoted to associate professor, Dr. Humphreys will have served in the rank for six years.

Ten external references were submitted as part of the promotion dossier, six chosen by the candidate and four by the department's budget council. One referee did not respond and another referee declined, indicating that he has too many commitments. Nine full professors from a broad range of departments at domestic and international institutions submitted letters, representing Stanford, Illinois, University of Colorado Boulder, University of California Riverside, Miami, Illinois Institute of Technology, University of New South Wales, University of New Brunswick, and University of Calgary. Although not all the letter writers are associated with peer institutions, most of the letter writers hold chaired professorships and are well recognized through their professional awards. One letter is written by a member of the National Academy of Engineering.

Teaching
Dr. Humphreys teaches courses in spacecraft dynamics and GPS-based navigation. Since joining UT, he has taught a total of ten classes (five different courses), including two undergraduate classes [ASE 366K, *Spacecraft Dynamics* (two times) and ASE 372N, *Satellite-Based Navigation* (three times)] and three graduate classes [ASE 389P7, *Global Positioning System* (three times); ASE 396, *Model Based Detection/Estimation* (one time); and ASE 381P8, *Stochastic Detection, Estimation and Control* (one time)]. Enrollment has ranged from 14 to 75 students in his undergraduate classes and from 5 to 24 in his graduate classes. Dr. Humphreys' average course instructor ratings range between 4.6 and 5.0 and his course ratings range between 4.3 and 4.9. His overall course instructor rating is 4.5 and his overall course rating is 4.63. Both are above the department and school averages.

Annual peer reviews conducted by full professors covering all courses taught by Dr. Humphreys are included in the dossier. All evaluations are very positive. It is clear that Professor Humphreys is a very enthusiastic instructor who is "a master of the course material and very much at home in the classroom" (Prof. Fowler). Professor Humphreys "has an engaging personality and is a charismatic teacher... I have been teaching for over 40 years and I think I learned a few things today..." (Prof. Hughes). Graduate courses taught by Professor Humphreys draw students from other departments especially electrical and computer engineering. The students' comments support the peer assessments.

The exemplary nature of Dr. Humphrey's teaching has been recognized by the UT System with the 2012 Regents' Outstanding Teaching Award and the Cockrell School of Engineering with the 2012 Dean's Award for Outstanding Teaching by an Assistant Professor.

Research
Dr. Humphreys' research is in the emerging area of the satellite navigation with thrusts in secure and robust perception, precision positioning and orientation for consumer mobile applications, and instrumentation for remote sensing. Dr. Humphreys directs the Radionavigation Laboratory, which is known for its research on secure

perception. Furthermore, his research influenced broad public policy related to the vehicles using Global Positioning Systems (GPS).

While in rank, Dr. Humphreys has published 16 refereed archival journal papers (13 are based on work at UT and three are based on his PhD work at Cornell). His career total is 18. These papers have appeared in selective journals, including *Navigation, Journal of the Institute of Navigation, Journal of Field Robotics, IEEE Transactions on Aerospace and Electronic Systems, International Journal of Critical Infrastructure Protection,* and *IEEE Journal of Selected Topics in Signal Processing*. He also has 34 refereed conference papers in rank (43 career total). Dr. Humphreys has also published twelve articles in the popular press, including *Scientific American* and *GPS World*. Using Google Scholar, his publications have been cited over 900 times and his h-index is 19. Dr. Humphreys holds two patents on work completed before he joined UT, and has submitted one patent application related to work at UT.

In 2012, Dr. Humphreys testified before the US House of Representatives Committee on Homeland Security and participated in a field forum sanctioned by the House Judiciary Subcommittee on Crime, Terrorism, and Homeland Security. He has also given 29 invited talks (including three keynote lectures) and one TedX talk.

Dr. Humphreys has received 14 external research grants, and he is UT lead on 13. He received direct federal funding from the Department of Defense (DTRA) and the US Air Force. He also has received industrial funding from Boeing, Lockheed Martin, Northrop Grumman, Harris, and Samsung. He has participated in three STTR awards (two to Coherent Navigation[1] and one to ASTRA) with funding from the US Navy and US Air Force. His collaborative research project is a US Department of Transportation center that includes researchers from the Center for Transportation Research and the Wireless Networking and Communications Group (WNCG). He has also received research gifts through WNCG and is an unfunded member of the research team for a project supported by the College of Natural Sciences Catalyst Grant Competition. Dr. Humphreys' total research funding is more than $4.5 million, and his share is more than $1.8 million (more than $1.7 million is external).

The external references highlight the high quality and impact of Dr. Humphreys' research and indicate that he has developed an international reputation for his work. While some of the referees are not associated with peer institutions, the budget council noted that this is "the nature of the global-navigation field since few of the top schools have strong researchers working in this area."

> Dr. Penina Axelrad (Colorado) writes, "His influence on the field of GPS security is quite remarkable for a faculty member at such an early stage in his career. Dr. Humphreys has published **the most highly cited articles** describing the threat spoofing to GPS use and innovative detection strategies to insure the validity of position and timing solutions. He is widely recognized and his work highly valued because he has addressed this important issue through both analytical developments and experimental demonstrations." "It is clear from his scholarly progress thus far, and the high level of engagement and leadership he already has in the GNSS community, that Dr. Humphreys has great promise to be a significant contributor and thought leader in the future."
>
> Dr. Per Enge (Stanford University, NAE) writes, "Dr. Humphreys has a bright future. The field of navigation security has just opened in the civilian community and will be a strong research area for the next ten to fifteen years. Dr. Humphreys will certainly be a leader in this vital and interesting effort. More importantly, his technical work shows deep underlying knowledge of signal processing, detection and estimation theory, and experimental work."
>
> Dr. Farzad Kamalabadi (Illinois) writes "… it became apparent that Professor Humphreys' expertise in positioning, navigation, and timing (PNT) solutions reach far beyond only the security and authentication

[1] Dr. Humphreys is a co-founder of Coherent Navigation.

aspects and cover diverse areas such as robust and energy-efficient next-generation GNSS receiver design and engineering, PNT coverage and integrity, and privacy. Professor Humphreys' breadth and depth in these areas impressed many of my senior collaborators and colleagues, which included several members of the National Academies." "In summary, on the basis of the analysis I have provided above, I enthusiastically endorse Professor Humphreys' advancement to the rank of Associate Professor with tenure at UT Austin."

Dr. Gerard Lachapelle (Calgary) writes, "The above accomplishments have occurred over a short period of 5 years. His development compared with others at research-intensive universities places him positively in the top 5% of his cohort. I firmly believe that his potential for further professional growth is exceptional. He already established himself as a leader in the area of GNSS. In conclusion, I find Professor Humphreys' research and professional records outstanding."

Advising and Student Mentoring

Dr. Humphreys has served as co-supervisor for two PhD students (one is now an assistant professor at UC Riverside). Both students were co-supervised with faculty in the Department of Electrical and Computer Engineering. He also co-supervised two MS students with faculty in his department. Finally, he has supervised three undergraduate students (two with an honors thesis). Currently, he is supervising five PhD students (one is co-advised). Dr. Kamalabadi (Illinois) commented that Dr. Humphreys "has been very effective at graduate student advising and mentoring, as evident by awards they have received while under his supervision." Dr. Pervan (Illinois Institute of Technology) noted that "his graduate students' presentations at conferences are always prepared to the highest standards."

University Service

Dr. Humphreys' university service is modest, but not unusual for an assistant professor. He has served as the faculty advisor for the UT student chapter of the American Institute of Aeronautics and Astronautics (AIAA) for several years. He is also a contributing member of the Wireless Networking and Communications Group. He served on one committee within the Cockrell School of Engineering.

Professional Service

Dr. Humphreys serves as editor of the *IEEE Transactions on Wireless Communications*, one of the five highest-impact IEEE journals. He also served on the executive committee of the Institute of Navigation as land representative (2013-present) and as track and session chairs for various professional conference and workshops.

Other Evidence of Merit or Recognition

Dr. Humphreys has been recognized for his scholarly contributions by a variety of different organizations. In 2012, he received GPS World Magazine Leadership Award. His students received Best Overall Paper and Best Student Paper Awards at IEEE/ION PLANS Conference in 2012. Finally, he won The University of Texas System Regents' Outstanding Teaching Award (2012) and the Cockrell School Dean's Award for Outstanding Teaching by an Assistant Professor (2012).

He has testified before the US Congress regarding unmanned aerial vehicle security and privacy issues, has advised the Central Intelligence Agency and the GPS Directorate of the US Air Force on the civil vulnerability to GPS deception, and directly contributed to Texas House Bill 912, which protects privacy by setting limits on the use of drones. Furthermore, Dr. Humphreys' work has received extensive coverage in the popular press through a TED talk (over 600,000 views), three panel sessions at SXSW, and media outlets such as NPR, BBC, PBS, CBS, CNN, FOX, ABC, CSPAN, and the New York Times.

Overall Assessment

In summary, Dr. Humphreys is an outstanding teacher and recognized researcher. He has been very successful in building his UT Radionavigation Laboratory and securing research funding. All external reference letters were supportive and uniformly recommend promotion.

Several aspects of Dr. Humphreys' case raised concerns among the promotion and tenure committee.

(1) Dr. Humphreys had not received a competitive federal grant, which is the traditional means for assistant professors to demonstrate the sustainability of their research funding. I am not concerned by this aspect of his case. He has secured funding from a variety of federal and industry sources, and the impact of his research has not been limited. As federal funding becomes more difficult to secure, we must be more flexible in this respect.
(2) All four of Dr. Humphreys' students who completed their graduate degrees have been co-supervised. If he had co-supervised the students with the same faculty member(s), I would possibly be concerned about his ability to develop an independent research program, but each student was co-supervised by a different faculty member (two in ECE and two in ASE). In addition, only one of his current students is co-supervised.
(3) He has received extensive coverage of his work in the popular press, which may imply that his work is too applied or lacks scientific merit. The external reviewers addressed the technical merits and original nature of his work. In addition, one of our goals within the Cockrell School is to promote the impact of our ongoing research. Dr. Humphreys enhances our efforts in this area.

Therefore, I believe that Dr. Humphreys meets or exceeds all expectations for promotion to associate professor and support this case without reservation.

Sharon L. Wood, Dean
9 November 2014

# Statistical Summary for "In Rank"
# Todd Humphreys

| Metric | Value |
|---|---|
| Peer-reviewed Journal Publications | 16 |
| Peer-reviewed Conference Publications | 34 |
| Corresponding Author on Peer-Reviewed Publications | 9/14 journal; 28/34 conference |
| Total Citations of all Publications (career)* | 933 |
| h-index (career)* | 19 |
| Google Scholar Total Citations of all Publications (career) | 933 |
| Google Scholar h-index (career) | 19 |
| Total Research Funding ($) | $4,567,640 |
| Candidate Share Research Funding ($) | $1,824,640 |
| Total Number of Grants/Contracts Received | 20 (14 external) |
| Number of Grants/Contracts Received as PI | 18 (13 external) |
| | |
| PhD Students Completed (count 1 if sole advisor, 0.5 if co-advised) | 0.5 + 0.5 = 1 (NB: Humphreys was *primary* advisor for both students) |
| MS Students Completed (count 1 if sole advisor, 0.5 if co-advised) | 1 |
| PhD Students in Pipeline (as of 09/2014) (count 1 if sole advisor, 0.5 if co-advised) | 0.5 + 4 = 4.5 (NB: Humphreys is *primary* advisor for the one co-advised student) |
| MS students in Pipeline (as of 09/2014) (count 1 if sole advisor, 0.5 if co-advised) | 0 |
| | |
| Courses Taught | 10 |
| # of Students Taught | 246 |
| Average Instructor Evaluation UG | 4.74 |
| Average Instructor Evaluation Grad | 4.76 |
| Average Course Evaluation UG | 4.56 |
| Average Course Evaluation Grad | 4.66 |
| Teaching Awards | UT Regents' Teaching Award |
| | |
| Student Organizations Advised | AIAA Student Organization |
| Undergraduates Supervised | 3 |
| Journal Editorial Boards | 1 (IEEE Transactions on Wireless Communications) |
| Symposia Organized | 2 (2013 Texas Wireless Summit; 2010 Civil GNSS Security Meeting) |

*Source:

☒ Publish or Perish (with Google Scholar input)

☐ ISI Web of Knowledge

# Candidate's Statement on Research

**Table 1. Research Summary**

| Metric | Value |
|---|---|
| Peer-Reviewed Journal Publications in Rank | 16 |
| Peer Reviewed Conference Proceedings Publications in Rank | 34 |
| Total Citations of all Publications (career)* | 933 |
| h-index (career)* | 19 |
| Google Scholar Total Citations of all Publications (career) | 933 |
| Google Scholar h-index (career) | 19 |
| Research Funding Raised (total share) | $4,567,640 |
| Research Funding Raised (candidate share) | $1,824,640 |
| Total Grants/Contracts Received | 14 |
| PI on Grants/Contracts Received | 13 |

**Table 2. External Grants and Contracts Awarded while in Rank**

Note: The table below reflects only funding *external to UT*. From *internal* UT sources, additional funds in the amount of $185,000 ($110,000 candidate share) were obtained. These internal funds came from the Wireless Networking and Communications Group and from the UT College of Natural Sciences.

| Co-Investigators | Title | Agency | Project Total/ | Candidate Share | Grant Period |
|---|---|---|---|---|---|
| None | Connected Autonomous Space Environment Sensors (CASES) Phase II STTR | AFOSR via ASTRA LLC | $224,491 | $224,491 | June 2009--March 2011 |
| None | CASES Adaptations for Antarctic Deployment | NSF via. ASTRA LLC | $120,000 | $120,000 | Jan. 2010--Dec. 2011 |
| None | Investigation into GPS jamming detection and localization techniques | Coherent Navigation, Inc. | $240,000 | $240,000 | Sept. 2010--July 2012 |
| None | IGPS technology concept demonstration time and frequency stability transfer model | Boeing | $120,000 | $120,000 | Sept. 2010--Jan. 2012 |
| None | FOTON sensor development | Lockheed Martin | $69,000 | $69,000 | |
| None | Cyber Critical Infrastructure Protection GPS Timing Proof of Concept | Northrop Grumman | $65,050 | $65,050 | Nov. 2011--Jan. 2012 |
| None | Emitter locator (EMLOC) system for emitter detection and localization---Phase I STTR | U.S. Navy via Coherent Navigation, Inc. | $34,000 | $34,000 | Aug. 2011--Mar. 2012 |
| None | GPS Vulnerability Simulation Support | Sandia Nat. Lab. | $40,083 | $40,083 | July 2012--Nov. 2012 |
| None | Research into UAV Navigation System Vulnerability to Spoofing Attacks | Harris Corp. | $75,000 | $75,000 | Sept. 2012--Aug. 2013 |
| None | Emitter locator (EMLOC) system for emitter detection and localization---Phase II STTR | U.S. Navy via Coherent Navigation, Inc. | $225,016 | $225,016 | April 2013--April 2015 |
| None | GPS Timing Phase II Proof of Concept | DOD (DTRA) via Northrop Grumman | $150,000 | $150,000 | June 2013--April 2014 |
| None | Strengthening GPS Receiver Resistance to Deceptive Civil Signals | US Air Force GPS Directorate | $120,000 | $120,000 | June 2013--June 2015 |
| None | Precise positioning for mobile devices | Samsung Research America | $100,000 | $100,000 | Jan. 2014--Jan. 2015 |
| PI: Chandra Bhat, UT CTR, 8 co- | Data-Supported Transportation Operations and Planning (D- | U.S. Dept. of Transportation | $2,800,000 | $132,000 | Sept. 2013--Sept. 2017 |

| | | | | | |
|---|---|---|---|---|---|
| investigators from CTR and WNCG | STOP) | | | | |
| **TOTAL** | | | $4,382,640 | **$1,714,640** | |

*Source:
☒ Publish or Perish (with Google Scholar input)
☐ ISI Web of Knowledge